

1 What is claimed is:

2
3 1. A method of operating a snapshot copy facility that stores a plurality of
4 snapshot copies of a production file system, each of the snapshot copies being a prior
5 state of the production file system at a respective point in time, said method comprising:

6 the snapshot copy facility receiving a request for the difference between a
7 specified older one of the snapshot copies and a specified younger one of the snapshot
8 copies; and

9 the snapshot copy facility responding to the request by returning the difference
10 between the specified older one of the snapshot copies and the specified younger one of
11 the snapshot copies.

12
13 2. The method as claimed in claim 1, wherein the production file system
14 includes blocks of data, and the snapshot copy facility returns an identification of each
15 block that has changed between the specified older one of the snapshot copies and the
16 specified younger one of the snapshot copies, and the snapshot copy facility returns the
17 data in the specified younger one of the snapshot copies for said each block that has
18 changed between the specified older one of the snapshot copies and the specified younger
19 one of the snapshot copies.

20
21 3. The method as claimed in claim 2, wherein the identifications of the
22 changed blocks and the data of the changed blocks are returned in a sequential block
23 number order.

1

2 4. The method as claimed in claim 1, wherein the snapshot copy facility has
3 an index for each snapshot copy for indicating changes between said each snapshot copy
4 and a next snapshot copy of the production file system, and the method includes scanning
5 the index for the specified older one of the snapshot copies.

6

7 5. The method as claimed in claim 4, wherein the index for at least one of the
8 snapshot copies is a bit map.

9

10 6. The method as claimed in claim 4, wherein the index for at least one of the
11 snapshot copies includes a hash table.

12

13 7. The method as claimed in claim 4, which includes scanning the indices for
14 a sequence of the snapshot copies including the index for the specified older one of the
15 snapshot copies and a respective index for each snapshot copy of the production file
16 system that is both younger than the specified older one snapshot copies and older than
17 the specified younger one of the snapshot copies.

18

19 8. The method as claimed in claim 7, wherein the indices for the sequence of
20 the snapshot copies are scanned by a program routine having an outer loop indexing
21 blocks of data in the file system, and an inner loop indexing the snapshot copies in the
22 sequence of the snapshot copies.

23

1 9. The method as claimed in claim 1, wherein the snapshot copy facility has
2 an index for each snapshot copy for indicating blocks of data that are known to be invalid
3 in said each snapshot copy, and the method includes scanning the index for the specified
4 younger one of the snapshot copies, and when the index indicates that a block is not
5 known to be invalid, then determining whether the block has changed between the
6 specified older one of the snapshot copies and the specified younger one of the snapshot
7 copies.

8
9 10. A method of operating a snapshot copy facility that stores a plurality of
10 snapshot copies of a production file system, each of the snapshot copies being a prior
11 state of the production file system at a respective point in time, the snapshot copy facility
12 having an index for each snapshot copy for indicating blocks of data in the production
13 file system that have changed between said each snapshot copy and a next snapshot copy
14 of the production file system, wherein the method comprises:

15 scanning the indices for a sequence of the snapshot copies to determine the
16 blocks that have changed between an older one of the snapshot copies and a younger one
17 of the snapshot copies, the sequence of the snapshot copies including the older one of the
18 snapshot copies and each of the snapshot copies that is both younger than the older one of
19 the snapshot copies and older than the younger one of the snapshot copies.

20
21 11. The method as claimed in claim 10, wherein at least one of the indices is a
22 bit map.

1 12. The method as claimed in claim 10, wherein at least one of the indices
2 includes a hash table.

3
4 13. The method as claimed in claim 10, which includes responding to a
5 request for the difference between the older one of the snapshot copies and a younger one
6 of the snapshot copies by:

7 returning a sequence of block numbers of the blocks that have changed between
8 the older one of the snapshot copies and the younger one of the snapshot copies, and

9 returning the data in the younger one of the snapshot copies for the blocks that
10 have changed between the older one of the snapshot copies and the younger one of the
11 snapshot copies.

12
13 14. The method as claimed in claim 13, wherein the block numbers of the
14 changed blocks and the data of the changed blocks are returned in a sequential block
15 number order.

16
17 15. The method as claimed in claim 10, wherein the indices for the sequence
18 of the snapshot copies are scanned by a program routine having an outer loop indexing
19 respective blocks, and an inner loop indexing snapshot copies in the sequence of the
20 snapshot copies.

21
22 16. The method as claimed in claim 15, wherein the snapshot copy facility has
23 a meta bit map for each snapshot copy for indicating blocks of data that are known to be

1 invalid in said each snapshot copy, and the method includes scanning the meta bit map
2 for the specified younger one of the snapshot copies, and when the meta bit map is found
3 to indicate that a block is not known to be invalid, then determining whether the block
4 has changed between the specified older one of the snapshot copies and the specified
5 younger one of the snapshot copies by scanning the indices for the sequence of the
6 snapshot copies.

7
8 17. A method of operating a snapshot copy facility that stores a plurality of
9 snapshot copies of a production file system, each of the snapshot copies being a prior
10 state of the production file system at a respective point in time, the snapshot copy facility
11 having a first index for each snapshot copy for indicating blocks of data in the production
12 file system that have changed between said each snapshot copy and a next snapshot copy
13 of the production file system and that have a "before image" saved for said each snapshot
14 copy, the snapshot copy facility having a second index for said each snapshot copy for
15 indicating blocks of data that are not in use in said each snapshot copy; said method
16 comprising:

17 responding to a request for the difference between a specified older one of the
18 snapshot copies and a specified younger one of the snapshot copies by accessing the
19 second index for the specified younger one of the snapshot copies to determine blocks of
20 data in the production file system that are in use in the specified younger one of the
21 snapshot copies, and for blocks of data in the production file system that are in use in the
22 specified younger one of the snapshot copies, accessing at least one of the first indices for
23 a sequence of the snapshot copies to determine blocks that have changed between an

1 older one of the snapshot copies and a younger one of the snapshot copies, the sequence
2 of the snapshot copies including the older one of the snapshot copies and each of the
3 snapshot copies that is both younger than the older one of the snapshot copies and older
4 than the younger one of the snapshot copies.

5
6 18. The method as claimed in claim 17, which also includes accessing at least
7 one of the second indices for the snapshot copies in the sequence of the snapshot copies
8 and finding that at least one of the blocks is not in use in at least one of the snapshot
9 copies in the sequence of the snapshot copies to determine that said at least one of the
10 blocks has changed between the older one of the snapshot copies and the younger one of
11 the snapshot copies not changed.

12
13 19. A method of operating a network file server, the network file server
14 having a snapshot copy facility for storing a plurality of snapshot copies of a production
15 file system, each of the snapshot copies being a prior state of the production file system at
16 a respective point in time, said method comprising:

17 the network file server receiving a request for an update to a specified snapshot
18 copy of the production file system;

19 the network file server responding to the request by checking whether the
20 snapshot copy facility contains the specified snapshot copy of the production file system,
21 and upon finding that the snapshot copy facility contains the specified snapshot copy of
22 the production file system, the network file server returning the difference between the

1 specified snapshot copy of the production file system and a more recent snapshot copy of
2 the production file system.

3
4 20. The network file server as claimed in claim 19, wherein the more recent
5 snapshot copy of the production file system is the most recent one of the snapshot copies
6 of the production file system that are stored in the snapshot copy facility.

7
8 21. The network file server as claimed in claim 19, wherein the request
9 specifies the more recent snapshot copy of the production file system.

10
11 22. The network file server as claimed in claim 19, wherein the network file
12 server returns the difference between the specified snapshot copy of the production file
13 system and the more recent snapshot copy of the production file system by returning a
14 series of block numbers for blocks of the production file system that have changed
15 between the specified snapshot copy of the production file system and the more recent
16 snapshot copy of the production file system, and returning the data in the more recent
17 snapshot copy of the production file system for said each block that has changed between
18 the specified one of the snapshot copies of the production file system and the more recent
19 snapshot copy of the production file system.

20
21 23. In a data processing network having a client and a network file server, the
22 network file server storing a plurality of snapshot copies of a production file system, each
23 of the snapshot copies being a prior state of the production file system at a respective

1 point in time, the client having a local version of an older one of the snapshot copies, a
2 method of providing the client with a younger one of the snapshot copies, the method
3 comprising:

4 the network file server determining the difference between the younger one of the
5 snapshot copies and the older one of the snapshot copies;

6 the network file server transmitting the difference between the younger one of the
7 snapshot copies and the older one of the snapshot copies to the local version of the older
8 one of the snapshot copies; and

9 writing the difference between the younger one of the snapshot copies and the
10 older one of the snapshot copies into the local version of the older one of the snapshot
11 copies to produce a local version of the younger one of the snapshot copies.

12
13 24. The method as claimed in claim 23, wherein the network file server
14 determines the difference between the younger one of the snapshot copies and the older
15 one of the snapshot copies in response to an update request from the client, the update
16 request specifying the older one of the snapshot copies.

17
18 25. The method as claimed in claim 23, wherein the network file server
19 determines the difference between the younger one of the snapshot copies and the older
20 one of the snapshot copies by determining blocks of the production file system that have
21 changed between the younger one of the snapshot copies and the older one of the
22 snapshot copies, and the network file server transmits the difference between the younger
23 one of the snapshot copies and the older one of the snapshot copies to the local version of

1 the younger one of the snapshot copies by transmitting block identifiers for the blocks of
2 the production file system that have changed between the younger one of the snapshot
3 copies and the older one of the snapshot copies, and by transmitting the data in the
4 younger one of the snapshot copies for the blocks of the production file system that have
5 changed between the younger one of the snapshot copies and the older one of the
6 snapshot copies.

7
8 26. A snapshot copy facility comprising:

9 storage for storing a plurality of snapshot copies of a production file system, each
10 of the snapshot copies being a prior state of the production file system at a respective
11 point in time; and

12 at least one processor programmed for receiving a request for the difference
13 between a specified older one of the snapshot copies and a specified younger one of the
14 snapshot copies; and for responding to the request by returning the difference between
15 the specified older one of the snapshot copies and the specified younger one of the
16 snapshot copies.

17
18 27. The snapshot copy facility as claimed in claim 26, wherein the production
19 file system includes blocks of data, and said at least one processor is programmed for
20 returning an identification of each block that has changed between the specified older one
21 of the snapshot copies and the specified younger one of the snapshot copies, and the
22 snapshot copy facility returns the data in the specified younger one of the snapshot copies

1 for said each block that has changed between the specified older one of the snapshot
2 copies and the specified younger one of the snapshot copies.

3
4 28. The snapshot copy facility as claimed in claim 27, wherein said at least
5 one processor is programmed to return the identifications of the changed blocks and the
6 data of the changed blocks in a sequential block number order.

7
8 29. The snapshot copy facility as claimed in claim 26, wherein the snapshot
9 copy facility has an index for each snapshot copy for indicating changes between said
10 each snapshot copy and a next snapshot copy of the production file system, and said at
11 least one processor is programmed for scanning the index for the specified older one of
12 the snapshot copies.

13
14 30. The snapshot copy facility as claimed in claim 29, wherein the index for at
15 least one of the snapshot copies is a bit map.

16
17 31. The snapshot copy facility as claimed in claim 29, wherein the index for at
18 least one of the snapshot copies includes a hash table.

19
20 32. The snapshot copy facility as claimed in claim 29, wherein said at least
21 one processor is programmed for scanning the indices for a sequence of the snapshot
22 copies including the index for the specified older one of the snapshot copies and a
23 respective index for each snapshot copy of the production file system that is both younger

1 than the specified older one snapshot copies and older than the specified younger one of
2 the snapshot copies.

3
4 33. The snapshot copy facility as claimed in claim 32, wherein said at least
5 one processor is programmed for scanning the indices for the sequence of the snapshot
6 copies by a program routine having an outer loop indexing the blocks, and an inner loop
7 indexing the snapshot copies in the sequence of the snapshot copies.

8
9 34. The snapshot copy facility as claimed in claim 26, wherein the snapshot
10 copy facility has an index for each snapshot copy for indicating blocks of data that are
11 known to be invalid in said each snapshot copy, and said at least one processor is
12 programmed for scanning the index for the specified younger one of the snapshot copies,
13 and when the index indicates that a block is not known to be invalid, then determining
14 whether the block has changed between the specified older one of the snapshot copies
15 and the specified younger one of the snapshot copies.

16
17 35. A snapshot copy facility comprising:
18 storage for storing a plurality of snapshot copies of a production file system, each
19 of the snapshot copies being a prior state of the production file system at a respective
20 point in time;

21 an index for each snapshot copy for indicating blocks of data in the production
22 file system that have changed between said each snapshot copy and a next snapshot copy
23 of the production file system, and

1 at least one processor programmed for scanning the indices for a sequence of the
2 snapshot copies to determine the blocks that have changed between an older one of the
3 snapshot copies and a younger one of the snapshot copies, the sequence of the snapshot
4 copies including the older one of the snapshot copies and each of the snapshot copies that
5 is both younger than the older one of the snapshot copies and older than the younger one
6 of the snapshot copies.

7
8 36. The snapshot copy facility as claimed in claim 35, wherein at least one of
9 the indices is a bit map.

10
11 37. The snapshot copy facility as claimed in claim 35, wherein at least one of
12 the indices includes a hash table.

13
14 38. The snapshot copy facility as claimed in claim 35, wherein the production
15 file system includes blocks of data, and said at least one processor is programmed to
16 respond to a request for the difference between the older one of the snapshot copies and a
17 younger one of the snapshot copies by:

18 returning a sequence of block numbers of the blocks that have changed between
19 the older one of the snapshot copies and the younger one of the snapshot copies, and

20 returning the data in the younger one of the snapshot copies for the blocks that
21 have changed between the older one of the snapshot copies and the younger one of the
22 snapshot copies.

23

1 39. The snapshot copy facility as claimed in claim 38, wherein said at least
2 one processor is programmed to return the block numbers of the changed blocks and the
3 data of the changed blocks in a sequential block number order.

4
5 40. The snapshot copy facility as claimed in claim 35, wherein said at least
6 one processor is programmed for scanning the indices for the sequence of the snapshot
7 copies by a program routine having an outer loop indexing the blocks, and an inner loop
8 indexing the snapshot copies in the sequence of the snapshot copies.

9
10 41. The snapshot copy facility as claimed in claim 35, which includes a meta
11 bit map for each snapshot copy for indicating blocks of data that are known to be invalid
12 in said each snapshot copy, and wherein said at least one processor is programmed for
13 scanning the meta bit map for the specified younger one of the snapshot copies, and when
14 the meta bit map is found to indicate that a block is not known to be invalid, then
15 determining whether the block has changed between the specified older one of the
16 snapshot copies and the specified younger one of the snapshot copies by scanning the
17 indices for the sequence of the snapshot copies.

18
19
20 42. A snapshot copy facility comprising:
21 storage for storing a plurality of snapshot copies of a production file system, each
22 of the snapshot copies being a prior state of the production file system at a respective
23 point in time;

1 a first index for each snapshot copy for indicating blocks of data in the production
2 file system that have changed between said each snapshot copy and a next snapshot copy
3 of the production file system and that have a "before image" for said each snapshot copy
4 stored in the storage,

5 a second index for each snapshot copy for indicating blocks of data that are not in
6 use in said each snapshot copy, and

7 at least one processor programmed for responding to a request for the difference
8 between a specified older one of the snapshot copies and a specified younger one of the
9 snapshot copies by accessing the second index for the specified younger one of the
10 snapshot copies to determine blocks of data in the production file system that are in use in
11 the specified younger one of the snapshot copies, and for blocks of data in the production
12 file system that are in use in the specified younger one of the snapshot copies, accessing
13 at least one of the first indices for a sequence of the snapshot copies to determine blocks
14 that have changed between an older one of the snapshot copies and a younger one of the
15 snapshot copies, the sequence of the snapshot copies including the older one of the
16 snapshot copies and each of the snapshot copies that is both younger than the older one of
17 the snapshot copies and older than the younger one of the snapshot copies.

18
19 43. The snapshot copy facility as claimed in claim 42, wherein said at least
20 one processor is also programmed for accessing at least one of the second indices for the
21 snapshot copies in the sequence of the snapshot copies and finding that at least one of the
22 blocks is not in use in at least one of the snapshot copies in the sequence of the snapshot

1 copies to determine that said at least one of the blocks has changed between the older one
2 of the snapshot copies and the younger one of the snapshot copies not changed.

3
4 44. A network file server comprising a snapshot copy facility for storing a
5 plurality of snapshot copies of a production file system, each of the snapshot copies being
6 a prior state of the production file system at a respective point in time,

7 wherein the network file server is programmed for receiving a request for an
8 update to a specified snapshot copy of the production file system, and responding to the
9 request by checking whether the snapshot copy facility contains the specified snapshot
10 copy of the production file system, and upon finding that the snapshot copy facility
11 contains the specified snapshot copy of the production file system, returning the
12 difference between the specified snapshot copy of the production file system and a more
13 recent snapshot copy of the production file system.

14
15 45. The network file server as claimed in claim 44, wherein the more recent
16 snapshot copy of the production file system is the most recent one of the snapshot copies
17 of the production file system that are stored in the snapshot copy facility.

18
19 46. The network file server as claimed in claim 44, wherein the request
20 specifies the more recent snapshot copy of the production file system.

21
22 47. The network file server as claimed in claim 44, wherein the network file
23 server is programmed to return the difference between the specified snapshot copy of the

1 production file system and the more recent snapshot copy of the production file system
2 by returning a series of block numbers for blocks of the production file system that have
3 changed between the specified snapshot copy of the production file system and the more
4 recent snapshot copy of the production file system, and the data in the more recent
5 snapshot copy of the production file system for said each block that has changed between
6 the specified one of the snapshot copies of the production file system and the more recent
7 snapshot copy of the production file system.

8
9 48. The network file server as claimed in claim 44, wherein the network file
10 server is programmed to return the more recent snapshot copy of the production file
11 system upon finding that the snapshot copy facility does not contain the specified
12 snapshot copy of the production file system.

13
14 49. A program storage device containing a program for a snapshot copy
15 facility, the snapshot copy facility storing a plurality of snapshot copies of a production
16 file system, each of the snapshot copies being a prior state of the production file system at
17 a respective point in time, wherein the program is executable for responding to a request
18 for the difference between a specified older one of the snapshot copies and a specified
19 younger one of the snapshot copies by returning the difference between the specified
20 older one of the snapshot copies and the specified younger one of the snapshot copies.

21
22 50. The program storage device as claimed in claim 49, wherein the program
23 is executable for returning an identification of each block that has changed between the

1 specified older one of the snapshot copies and the specified younger one of the snapshot
2 copies, and for returning the data in the specified younger one of the snapshot copies for
3 said each block that has changed between the specified older one of the snapshot copies
4 and the specified younger one of the snapshot copies.

5
6 51. The program storage device as claimed in claim 50, wherein the program
7 is executable for returning the identifications of the changed blocks and the data of the
8 changed blocks in a sequential block number order.

9
10 52. The program storage device as claimed in claim 49, wherein the snapshot
11 copy facility has an index for each snapshot copy for indicating changes between said
12 each snapshot copy and a next snapshot copy of the production file system, and the
13 program is executable for scanning the index for the specified older one of the snapshot
14 copies.

15
16 53. The program storage device as claimed in claim 52, wherein the program
17 is executable for scanning the indices for a sequence of the snapshot copies including the
18 index for the specified older one of the snapshot copies and a respective index for each
19 snapshot copy of the production file system that is both younger than the specified older
20 one snapshot copies and older than the specified younger one of the snapshot copies.

21
22 54. The program storage device as claimed in claim 53, wherein the program
23 is executable for scanning the indices for the sequence of the snapshot copies by a

1 program routine having an outer loop indexing the blocks, and an inner loop indexing the
2 snapshot copies in the sequence of the snapshot copies.

3
4 55. A program storage device containing a program for a snapshot copy
5 facility, the snapshot copy facility having a plurality of snapshot copies of a production
6 file system, each of the snapshot copies being a prior state of the production file system at
7 a respective point in time, and an index for each snapshot copy for indicating blocks of
8 data in the production file system that have changed between said each snapshot copy and
9 a next snapshot copy of the production file system, wherein the program is executable for
10 scanning the indices for a sequence of the snapshot copies to determine the blocks that
11 have changed between an older one of the snapshot copies and a younger one of the
12 snapshot copies, the sequence of the snapshot copies including the older one of the
13 snapshot copies and each of the snapshot copies that is both younger than the older one of
14 the snapshot copies and older than the younger one of the snapshot copies.

15
16 56. The program storage device as claimed in claim 55, wherein the program
17 is executable for responding to a request for the difference between the older one of the
18 snapshot copies and a younger one of the snapshot copies by:

19 returning a sequence of block numbers of the blocks that have changed between
20 the older one of the snapshot copies and the younger one of the snapshot copies, and

21 returning the data in the younger one of the snapshot copies for the blocks that
22 have changed between the older one of the snapshot copies and the younger one of the
23 snapshot copies.

1
2 57. The program storage device as claimed in claim 56, wherein the program
3 is executable for returning the block numbers of the changed blocks and the data of the
4 changed blocks in a sequential block number order.
5

6 58. The program storage device as claimed in claim 55, wherein the program
7 is executable for scanning the indices for the sequence of the snapshot copies by a
8 program routine having an outer loop indexing the blocks, and an inner loop indexing the
9 snapshot copies in the sequence of the snapshot copies.
10

11 59. The program storage device as claimed in claim 55, wherein the snapshot
12 copy facility has a meta bit map for each snapshot copy for indicating blocks of data that
13 are known to be invalid in said each snapshot copy, and wherein the program storage
14 device is executable for scanning the meta bit map for the specified younger one of the
15 snapshot copies, and when the meta bit map is found to indicate that a block is not known
16 to be invalid, then determining whether the block has changed between the specified
17 older one of the snapshot copies and the specified younger one of the snapshot copies by
18 scanning the indices for the sequence of the snapshot copies.
19

20 60. A program storage device containing a program for a snapshot copy
21 facility, the snapshot copy facility having a plurality of snapshot copies of a production
22 file system, each of the snapshot copies being a prior state of the production file system at
23 a respective point in time, a first index for each snapshot copy for indicating blocks of

1 data in the production file system that have changed between said each snapshot copy and
2 a next snapshot copy of the production file system and that have a "before image" for
3 said each snapshot copy stored in the snapshot copy facility, and a second index for each
4 snapshot copy for indicating blocks of data that are not in use in said each snapshot copy,
5 wherein the program is executable for responding to a request for the difference between
6 a specified older one of the snapshot copies and a specified younger one of the snapshot
7 copies by accessing the second index for the specified younger one of the snapshot copies
8 to determine blocks of data in the production file system that are in use in the specified
9 younger one of the snapshot copies, and for blocks of data in the production file system
10 that are in use in the specified younger one of the snapshot copies, accessing at least one
11 of the first indices for a sequence of the snapshot copies to determine blocks that have
12 changed between an older one of the snapshot copies and a younger one of the snapshot
13 copies, the sequence of the snapshot copies including the older one of the snapshot copies
14 and each of the snapshot copies that is both younger than the older one of the snapshot
15 copies and older than the younger one of the snapshot copies.

16
17 61. The program storage device as claimed in claim 60, wherein the program
18 is executable for accessing at least one of the second indices for the snapshot copies in
19 the sequence of the snapshot copies and finding that at least one of the blocks is not in
20 use in at least one of the snapshot copies in the sequence of the snapshot copies to
21 determine that said at least one of the blocks has changed between the older one of the
22 snapshot copies and the younger one of the snapshot copies not changed.

23

1
2 62. A program storage device containing a program for a network file server,
3 the network file server including a snapshot copy facility for storing a plurality of
4 snapshot copies of a production file system, each of the snapshot copies being a prior
5 state of the production file system at a respective point in time,

6 wherein the program is executable for receiving a request for an update to a
7 specified snapshot copy of the production file system, and responding to the request by
8 checking whether the snapshot copy facility contains the specified snapshot copy of the
9 production file system, and upon finding that the snapshot copy facility contains the
10 specified snapshot copy of the production file system, returning the difference between
11 the specified snapshot copy of the production file system and a more recent snapshot
12 copy of the production file system.

13
14 63. The program storage device as claimed in claim 62, wherein the more
15 recent snapshot copy of the production file system is the most recent one of the snapshot
16 copies of the production file system that are stored in the snapshot copy facility.

17
18 64. The program storage device as claimed in claim 62, wherein the request
19 specifies the more recent snapshot copy of the production file system.

20
21 65. The program storage device as claimed in claim 62, wherein the program
22 is executable for returning the difference between the specified snapshot copy of the
23 production file system and the more recent snapshot copy of the production file system

1 by returning a series of block numbers for blocks of the production file system that have
2 changed between the specified snapshot copy of the production file system and the more
3 recent snapshot copy of the production file system, and returning the data in the more
4 recent snapshot copy of the production file system for said each block that has changed
5 between the specified one of the snapshot copies of the production file system and the
6 more recent snapshot copy of the production file system.

7
8 66. The program storage device as claimed in claim 62, wherein the program
9 is executable for returning the more recent snapshot copy of the production file system
10 upon finding that the snapshot copy facility does not contain the specified snapshot copy
11 of the production file system.

12